Claims

1. A method of reconstructing a tomographic image from fan-beam or cone beam data, such method comprising the steps of:

collecting fan-beam or cone-beam data over an image space;

converting the fan-beam to parallel-beam data with respect to a rotation angle within the image space or converting the cone-beam data to parallel fan-beam data;

performing a shift variant filtration of the parallel-beam data within the image space; and

converting the processed data to images through backprojection or other means.

2. The method of reconstructing the tomographic image as in claim 1 further comprising reconstructing an image from the filtered parallel-beam data using a filtered backprojection algorithm.

3. The method of reconstructing the tomographic image as in claim 1 further comprising defining the fan-beam or cone-beam data as half-scan fan beam data.

4. The method of reconstructing the tomographic image as in claim 1 further comprising defining the fan-beam data as helical-scan data.

5. The method of reconstructing the tomographic image as in claim 1 further comprising defining the fan-beam or cone-beam data as data collected from an object that is offset within the data space.

6. The method of reconstructing the tomographic image as in claim 1 further comprising performing a Fourier expansion on the data with respect to a rotation angle

7. The method of reconstructing the tomographic image as in claim 6 further comprising linearly shifting the transformed data.

8. The method of reconstructing the tomographic image as in claim 7 further comprising performing an inverse Fourier transform on the shifted data.

9. An apparatus for reconstructing a tomographic image from fan-beam or cone beam data, such apparatus comprising:

means for collecting fan-beam or cone-beam data over an image space;

means for converting the fan-beam to parallel-beam data with respect to a rotation angle within the image space or cone-beam data to parallel fan-beam data;

means for performing a shift variant filtration of the parallel-beam data within the image space; and

means for conversion of the processed data to images through backprojection or other means.

10. The apparatus for reconstructing the tomographic image as in claim 9 further comprising means for reconstructing an image from the filtered parallel-beam data using a filtered backprojection algorithm.

11. The apparatus for reconstructing the tomographic image as in claim 9 further comprising defining the fan-beam or cone-beam data as half-scan fan beam data.

12. The apparatus for reconstructing the tomographic image as in claim 9 further comprising defining the fan-beam as helical-scan data.

13. The apparatus for reconstructing the tomographic image as in claim 9 further comprising defining the fan-beam or cone-beam data as data collected from an object that is offset within the data space.

14. The apparatus for reconstructing the tomographic image as in claim 9 further comprising means for performing a Fourier expansion on the data with respect to a rotation angle

15. The apparatus for reconstructing the tomographic image as in claim 14 further comprising means for linearly shifting the transformed data.

16. The apparatus for reconstructing the tomographic image as in claim 15 further comprising means for performing an inverse Fourier transform on the shifted data.

17. An apparatus for reconstructing a tomographic image from fan-beam or cone beam data, such apparatus comprising:

a sampling system adapted to collect fan-beam or cone-beam data over an image space;

a fourier processor adapted to convert the fan-beam or cone-beam data to parallel-beam data with respect to a rotation angle within the image space or the cone-beam data to parallel fan-beam data;

a shift variant filter adapted to perform a linear shift of the parallel-beam data within the image space; and

a reconstruction processor adapted to convert of the processed data to images through backprojection or other means.

18. The apparatus for reconstructing the tomographic image as in claim 17 wherein the reconstruction processor further comprising a software application for reconstructing an image from the filtered parallel-beam data using a filtered backprojection algorithm.

19. The apparatus for reconstructing the tomographic image as in claim 17 further comprising defining the fan-beam or cone-beam data as half-scan fan beam data.

20. The apparatus for reconstructing the tomographic image as in claim 17 further comprising defining the fan-beam or cone-beam data as helical-scan data.

21. The apparatus for reconstructing the tomographic image as in claim 17 further comprising defining the fan-beam or cone-beam data as data collected from an object that is offset within the data space.

22. The apparatus for reconstructing the tomographic image as in claim 17 wherein the fourier processor further performs a Fourier expansion on the data with respect to a rotation angle

23. The apparatus for reconstructing the tomographic image as in claim 15 wherein the fourier processor further performs an inverse Fourier transform on the shifted data.

24. A method of reconstructing a tomographic image from data acquired with a fan beam configuration with constant or spatial variant focal lengths, such method comprising the steps of:

performing a fast Fourier transform on the fan beam data with respect to a set of view angles;

forming a linear combination of complementary data elements of the transformed data, lying at complementary projection angles;

filtering the linear combination of complementary data elements in the spatial domain; and

reconstructing an image from the filtered linear combination of complementary data elements using a filtered backprojection algorithm.

25. The method of reconstructing a tomographic image as in claim 24 wherein the step of filtering further comprises using shift variant filtration.

26. The method of reconstructing a tomographic image as in claim 24 wherein the step of filtering further comprises multiplying the linear combination of complimentary data elements by a squared trigonometric function.

27. The method of reconstructing a tomographic image as in claim 26 wherein the squared trigonometric function further comprises a first cosine function divided by a second cosine function.

28. The method of reconstructing a tomographic image as in claim 27 wherein the first cosine function further comprises the cosine of a reference angle minus a detector angle divided by two.

29. The method of reconstructing a tomographic image as in claim 27 wherein the second cosine function further comprises the cosine of a reference angle plus a detector angle divided by two.

30. The method of reconstructing a tomographic image as in claim 25 wherein the step of reconstructing an image from the filtered linear combination of complementary data elements using a filtered backprojection algorithm further comprises multiplying an integral of a rotation angle by one over a value equal to two times a focal length.

31. An apparatus for reconstructing a tomographic image from data acquired with a fan beam configuration with constant or spatial variant focal lengths, such apparatus comprising:

means for performing a fast Fourier transform on the fan beam data with respect to a set of view angles;

means for forming a linear combination of complementary data elements of the transformed data, lying at complementary projection angles;

means for filtering the linear combination of complementary data elements in the spatial domain; and

means for reconstructing an image from the filtered linear combination of complementary data elements using a filtered backprojection algorithm.

32. The apparatus for reconstructing a tomographic image as in claim 31 wherein the means for filtering further comprises means for using shift variant filtration.

33. The apparatus for reconstructing a tomographic image as in claim 31 wherein the apparatus for filtering further comprises apparatus for multiplying the linear combination of complimentary data elements by a squared trigonometric function.

34. The apparatus for reconstructing a tomographic image as in claim 33 wherein the squared trigonometric function further comprises a first cosine function divided by a second cosine function.

35. The apparatus for reconstructing a tomographic image as in claim 23 wherein the first cosine function further comprises the cosine of a reference angle minus a detector angle divided by two.

36. The apparatus for reconstructing a tomographic image as in claim 35 wherein the second cosine function further comprises the cosine of a reference angle plus a detector angle divided by two.

37. The apparatus for reconstructing a tomographic image as in claim 31 wherein the means for reconstructing an image from the filtered linear combination of complementary data elements using a filtered backprojection algorithm further comprises means for multiplying an integral of a rotation angle by one over a value equal to two times a focal length.

38. An apparatus for reconstructing a tomographic image from data acquired with a fan beam configuration with constant or spatial variant focal lengths, such apparatus comprising:

a Fourier processor adapted to perform a fast Fourier transform on the fan beam data with respect to a set of view angles;

a combination processor adapted to form a linear combination of complementary data elements of the transformed data, lying at complementary projection angles;

a spatial filter adapted to filter the linear combination of complementary data elements in the spatial domain; and

a reconstruction processor adapted to reconstruct an image from the filtered linear combination of complementary data elements using a filtered backprojection algorithm.

39. The apparatus for reconstructing a tomographic image as in claim 38 wherein the spatial filter further comprises a shift variant filter.

40. The apparatus for reconstructing a tomographic image as in claim 38 wherein the filter further comprises a squared trigonometric function.

41. The apparatus for reconstructing a tomographic image as in claim 40 wherein the squared trigonometric function further comprises a first cosine function divided by a second cosine function.

42. The apparatus for reconstructing a tomographic image as in claim 41 wherein the first cosine function further comprises the cosine of a reference angle minus a detector angle divided by two.

43. The apparatus for reconstructing a tomographic image as in claim 42 wherein the second cosine function further
comprises the cosine of a reference angle plus a detector angle divided by two.

44. The apparatus for reconstructing a tomographic image as in claim 38 wherein the reconstruction processor further comprises an arithmetic processor adapted to multiply an integral of a rotation angle by one over a value equal to two times a focal length.